# GOVERNMENT COLLEGE OF ENGINEERING, JALGAON
**(An Autonomous Institute of Government of Maharashtra)**
National Highway No.6, JALGAON – 425 002

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|---|---|
| Phone No.: 0257-2281522 | Fax No.: 0257-2281319 |
| Website : www.gcoej.ac.in | E-mail : princoej@redifmail.com |

Name of Examination : **Summer 2021** - (Preview)

Course Code & Course Name : **ME354 - Machine Design ?II**

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Maximum Marks : **60**　　　　　Duration : **3 Hrs**

Edit　Print　View Answer Key　Close　**Answer Key Submission Type:** Marking scheme with model answers and solutions of numerical

Instructions:

1. *All questions are compulsory.*
2. *Illustrate your answer with suitable figures/sketches wherever necessary.*
3. *Assume suitable additional data; if required.*
4. *Use of logarithmic table, drawing instruments and non programmable calculators is allowed.*
5. *Figures to the right indicate full marks.*

**1)**　Solve **any three** of the following

a) The following data is given for a pair of spur gear with 20º full depth involutes teeth. [6]
No. of teeth on pinion = 24, No. of teeth on gear = 56, Face width = 30 mm, Pinion rotates at = 1000 rpm, Module = 3 mm, Service factor = 1.5. Gears are made of steel having Sut = 600 MPa. Using velocity factor to account dynamic load, calculate Rated power, if factor of safety is 1.5

b) The following data is given for a steel helical gear pair transmitting 150 kW power from a shaft rotating at 1440 rpm to another parallel shaft- rotating at 360 rpm, Centre distance is 435 mm. Helix angle is 24º, face width is 14 mm No. of teeth on pinion is 20, permissible bending stress for pinion material 152 MPa, permissible bending stress for gear material is 125 MPa, tooth system is 20º full depth involute, Service factor is 1.53, combined teeth error is 0.0406 mm, deformation factor is 11600 e N/mm Calculate factor of safety against bending failure. [6]

c) Derive beam strength equation of spur gear. [6]

d) Explain Gear tooth Failure. [6]

**2)**　Solve **any three** of the following

a) A pair of bevel gear with 20º pressure angle, consists of a 20 teeth pinion meshing with 30 teeth gear. The module is 4mm, while face width is 20mm. The material for the pinion & gear is steel 50C4 (Sut = 750MPa) The gear teeth are lapped & ground (Class – 3) & surface hardness is 400 BHN. The pinion rotates at 500rpm & receives 2.5kW power from the electric motor. The starting torque of the motor is 150% of the rated torque. Determine the factor of safety against bending & pitting failure. [6]

b) A two-start worm drives a 60 teeth phosphor bronze gear. The axial module is 6mm, having normal pressure angle as 20º. The diametral factor as 10. Find the factor of safety in bending & wear if the worm is to transmit 7kW at 1800 rpm, Assume μ = 0.05, $\sigma_{b=}$ 110MPa, K 0.83MPa, Y = 0.392 [6]

c) Explain force analysis of worm and worm gears. [6]

d) Explain the terminology of Bevel gear. [6]

**3)**　Solve **any three** of the following.

a) Single row deep groove ball bearing is subjected to a 30 sec work cycle that consists of the following two parts. The static & dynamic load capacities of ball bearing are 50 & 68 kN respectively. Calculate the expected life of the bearing in hours. [6]

|  | Part – I | Part – II |
|---|---|---|
| Duration (sec) | 10 | 20 |
| Radial load (kN) | 45 | 15 |
| Axial load (kN) | 12.5 | 6.25 |
| Speed rpm | 720 | 1440 |

b) A pressure vessel consists of a cylindrical shell of inside diameter 1650 mm, that is closed by Torispherical heads with a crown radius of 1300 mm. The operating pressure inside the vessel is 1.5 Mpa. The yield strength of the material used for shall and head is 255 N/mm$^2$, F.S =1.5 and the weld joint efficiency may be assumed 0.8. The corrosion allowance is 2 mm. Determine the thickness of the cylindrical shell and the Torispherical head [6]

c) Explain the basic procedure for the selection of bearing from the manufacturer's catalogue. [6]

d) Define autofrettage and explain various methods of pre-stressing the cylinder. [6]

**4)**　Solve the following

a) Explain Basic types of product forms. [3]

b) Explain Aesthetic & ergonomic in design. [3]

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